different technologies and system designs. Little investigation has been conducted to quantify the relative mechanical strengths of various plate designs and configurations to determine the most effective means of achieving rigid internal fixation of the mandible.

This study compares the relative biomechanical strengths of three different techniques of mandibular fixation using two different plating systems. A beef rib mandibular fracture model with dimensions similar to the human mandible was utilized. Uniform fractures were created using a microsaw. Fixation was then performed using one of three different techniques: six screw eccentric dynamic compression plates (EDCP), six screw reconstruction plates (RECON) and a paired system using a four screw dynamic compression plate with a two screw tension band (DCP + TB). Six models were prepared and tested for each technique using plates from the Synthes/A-O mandibular system and plates from a newly developed mandibular system which incorporates a down sized, low contact titanium plate design for use with 2.4 mm screws. Each of the six systems was tested on six models (n = 36). The plated fracture models were then mounted in an Instron tensiometer and a load applied 3 cm anterior to the experimental fracture site at a rate of 1 cm per minute until failure. Loading data was graphically recorded and evaluation of the mode of failure noted.

The load sustained by the model at the time of failure for the 2.4 mm Low contact systems were: EDCP 13.9 kg (12.5-15.2), DCP + TB 33.1 kg (21.5-46.0) and RECON 17.1 kg (16.0-20.5). Loads recorded for the 2.7 mm systems were: EDCP 33.4 kg (30.0-41.7), DCP + TB 55.5 kg (46.0-60.5), and RECON 30.4 kg (22.0-40.0).

Failure of the 2.4 mm DCP + TB, the 2.7 mm EDCP and the 2.7 mm DCP + TB occurred primarily at the screw-bone interface. Failure of the 2.4 mm EDCP occurred by plate deformation. The 2.4 mm and 2.7 mm reconstruction plates failed by deformation of the plates at the bending joints.

Conclusions: For all tested fixation techniques the 2.7 mm system sustained significantly greater loads than the comparable 2.4 mm system. The 2.4 mm EDCP and 2.4 mm RECON sustained the smallest loads and the 2.7 mm DCP + TB sustained the greatest loads before failure. Failure of the plates (2.4 EDCP, 2.4 Recon, 2.7 Recon) at subfunctional loads indicates fixation that could undergo permanent deformation during function. This problem was always avoided with a paired plate system.

References

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CAD-CAM Generated Mandibular Mod… Prototype From MRI Data

Sean C. Huckins, SUNY at Buffalo, Roswell Par… Graduate Division and Sisters of Charity Hospital… Main St., Suite 303, Buffalo, NY 14214 (Campbell, J.H., Mazurchuk, R.V., Baier, R.E.)

Computer-aided design/computer-aided manuf… ing (CAD/CAM) of three dimensional (3-D) models on radiographic imaging data currently requires … computed tomography (CT).[1] Although 3-D, com… enhanced MRI images have been developed,[2] tha… no reports of MRI data digitized to direct a nume… controlled milling machine. This study utilized co… tional MRI scans to generate an actual three dimen… model of the human mandible.

A phantom model of an edentulous cadaver ma… was cast in poly(methylmethacrylate) (PMMA). … bone, PMMA is not ordinarily imaged by MRI. … model was submerged in a 60 mM copper sulfate (C… solution to simulate the soft tissue envelope surrou… the mandible in vivo. Coronal sections of the P… mandible were imaged at 1 mm increments on a 1.… General Electric Signa Advantage whole-body MR s… T1 weighted images were obtained because of in… faster scan times and better anatomic definition; … generates a more intense signal than water in T1 we… images due to its paramagnetic properties. Films w… veloped directly from the MR system and the image… hand-transferred to bond paper utilizing a referenc… The transferred images were digitized with a digi… pad and puck. 3-D computer images of the digitized … sections were constructed with HURCO ULTIMA… AutoCAD software on a Nebula XT-12 IBM compa… computer. The AutoCAD file was then employed to … a tool path for a HURCO CNC ("computer numer… controlled") Knee type milling machine. A block of … wood was positioned and secured onto the HURCO … and a wood model of the MRI-scanned PMMA mand… was manufactured. This model was foreshortened … anterior-posterior direction compared to the PM… mandible by approximately 20%.

A customized, true scale model of patient anato… a powerful adjunct to diagnosis and treatment… models aid not only dental implant placement, bu… will allow construction of custom prostheses and pl… cation of appropriately formed metallic plates fo… toration of continuity defects. To our knowledge, … models are now available only from CT imaging d… major disadvantage of this technique is the utilizat… ionizing radiation necessary to generate accurate i… and models, typically 25 cGy for 3 mm overlappin… of the mandible. MRI is a means of obtaining de… anatomic and physiologic patient data in virtually u… ited quantities without exposing the patient to the p… tially harmful effects of ionizing radiation. This in…